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REPORT

OF THE

ESTIMATED COST

OF THE

North Carolina & Western Railroad.

RALEIGH:

W. W. HOLDEN, PRINTER TO THE STATE.

1854.

[Document No. 4, accompanying Governor's Message.—
Ordered to be printed.]

*To the Honorable the General Assembly
of the State of North Carolina:*

I herewith transmit the Report of Col. Walter Gwynn, Chief Engineer of the Survey of the North Carolina and Western Railroad Route.

The Engineer found the appropriation insufficient to complete the survey, and had therefore to supply the deficit from his own means, or to abandon the work without being finished. He pursued the former course, and I recommend that the General Assembly refund to him the amount thus expended.

DAVID S. REID.

EXECUTIVE DEPARTMENT, }
Raleigh, December 5, 1854. }

RALEIGH, December 5, 1854.

His Excellency, DAVID S. REID:

Sir—I have the honor herewith to submit my Report of the estimated cost of the North Carolina and Western Railroad. The maps referred to in the report are not all completed; they will be finished in a few days and handed in.

I beg here to call the attention of your Excellency to the fact which I verbally mentioned some time since, that the appropriation for the surveys proving inadequate, they were continued upon my own responsibility for the excess of expenditures over and above the appropriation.

I have the honor to be,

Your Excellency's most ob't serv't,

WALTER GWYNN,
Chief Engineer Surveys N. C. & W. R. R.

197461



REPORT.

RALEIGH, DECEMBER 5th, 1854.

His Excellency, David S. Reid :

SIR: I have the honor to lay before you the result of the surveys for the North Carolina and Western Railroad.

I was appointed to make the surveys for this road in July, 1853. On the 16th of August following, a party of Engineers was organised, and the survey was commenced at the mouth of Silver creek. Before the close of the season, a line was run to the Tennessee line, through the Swananoa Gap, and the valley of French Broad River. Field operations were then suspended, and were not resumed until April, when two parties were sent into the field.

For my guide in the discharge of the important duty confided to me, I have kept constantly before me the requirement of the act of the Legislature to make "a survey of the most practicable route for a Railroad from some point on the North Carolina Railroad, at or near the town of Salisbury, across the Blue Ridge to the Tennessee line."

The topographical features of the country indicate four routes for the proposed railroad, which will be best designated by the nomenclature of the mountain passes, viz: The Watauga, Linville, Swananoa, and Reedy Patch Gaps. All four routes are common to some point on the ridge, dividing the waters of the Yadkin and Catawba; from this point the route to the Watauga Gap, would be separate and distinct from the others, which would con-

tinue to occupy the same ground to the valley of the Catawba, where the Reedy Patch Gap route would fork to the South, and the Swannanoa and Linville Gap routes would continue on together to Linville river, where they would separate, Swannanoa Gap route pursuing the valley of the Catawba, and the Linville Gap route the valley of Linville river. The Watauga Gap route strikes the State line in the valley of the Watauga river about forty miles from Jonesboro', and thirty-three miles from the "camp ground," said to be an eligible point for forming a connection with the East Tennessee and Virginia Railroad. The length of this line from Salisbury, the starting point of all the routes to the Tennessee line, would be about $121.\frac{77}{100}$ miles. The Linville Gap route terminates on the State line in the valley of Doe river; its length would be about 125* miles. The Swannanoa and Reedy Patch Gap routes strike the State line at the Paint Rock in the valley of the French Broad river, distant about 80 miles from Greenville on the East Tennessee and Virginia Railroad. The length of these routes are respectively $186.\frac{78}{100}$ and 195* miles.

A reconnoissance of these several routes led to the determination to survey the Swannanoa and Watauga Gap routes. Reedy Patch route, besides opposing great difficulties in passing from the valley of the Catawba to that of Broad river, presents the insuperable objection in the passage of the Blue Ridge of a resort to "*five inclined planes*, which it would be necessary to surmount by stationary power, as the grades are too steep for the most powerful engine to work with proper effect." This is the language employed by Gen. William G. McNeill in his description of the Reedy Patch Gap, in his report on the surveys for the Louisville, Cincinnati, and Charleston Railroad in 1837. For this reason, Gen. McNeill dis-

* Measured on the map of this State.

carded it from his list of practicable locomotive routes, and for the same reason I decided against applying the limited means at command to a survey of it.

The great and leading objection to the Linville Gap route presents itself in the valley of Linville river, which for a distance of about twelve miles is shut up in a crooked gorge between the Linville and Short-off mountains, which opposes at almost every point, precipitous, cliffs and high mural precipices, rendering the valley hardly accessible to the tread of human foot. This difficulty might be avoided by ascending Canoe Creek, which heads on the east side of Table Mountain; but the passage of the mountain would present such serious difficulties, that it is doubtful whether it would be more practicable than the valley of the Linville.

These considerations determined me, although I entertained strong doubts as to the practicability of the Watauga route, arising from the great elevation of the mountain pass, very discernable to the eye, to select it for a comparison with the Swananoa route.

Discarding, therefore, any farther consideration of the other routes, I shall proceed as briefly as possible to present the results of the surveys.

Commencing with the Swananoa Gap route, which for convenience of description, I will divide into four sections, viz:—The Western, Mountain, Piedmont, and Eastern sections.

I.—THE WESTERN SECTION,

from the Paint Rock to the mouth of Flat Creek, 58 miles.

The line was traced on the south side of the French Broad river for a distance of 42 miles, it was then conducted across to the north side, and continued on that side to the mouth of the Swananoa, which river it ascends to its junction with Flat Creek. In order to avoid

some abrupt meanderings in the Swananoa river, and the precipitous cliffs, which confine the river in its sinuous course, at two points, it was thought advisable to leave the valley and cut through the narrow ridges lying in the bends; with these exceptions, the line is traced along the side slopes or across the bottoms and around the cliffs, which make into the French Broad and Swananoa; continuously alternating between cliffs, steep hill sides, and bottom lands, a minute description of the line would be a continued repetition of details presented in the accompanying tables marked A B C and D, and in the delineation of this line on the sheets, numbered from 1 to 6, inclusive. The tables give the localities of the bridges, the rate of grade and curvature, &c. An examination of these will show that at one point in the valley of the French Broad the grade is 51 feet to the mile, and in crossing one of the bends of the Swananoa above mentioned, it is increased to 68 feet per mile, that the least radius of curvature is 674 feet, which, as well as the grade, is within the limits found on some of the principal roads laid on the western slope of the Blue Ridge.

The cost of this section is estimated at \$1,139,919.

II.—THE MOUNTAIN DIVISION.

From the mouth of Flat Creek to the mouth of Crooked Creek, $20\frac{68}{100}$ miles.

After several trial lines across the mountain, one passing through Laquey's Gap, a description of which and the causes which led to their abandonment, would only tend to confuse and embarrass the subject. The line selected as the most feasible passes up a branch of Flat Creek, ascending at the rate of 26 and 68 feet to the mile, to a level grade 800 feet in length; from the end of this grade the mountain will be pierced with a tunnel 320 feet below the summit, through which there is a grade

descending at the rate of 100 feet per mile. The length of the tunnel is 7,900 feet from the eastern portal, the line continues very direct for about two miles, it then turns southward and is laid along the eastern slope of the main mountain, meandering around Young's Creek and other branches of the Catawba, tunneling and cutting through the ridges which divide them, until it crosses over and arrives on the south side of Allison's creek, one of the main tributaries of the Catawba, thence it follows alternately the slopes of spurs thrown out from Mendenhall's, Clark's and Edmonson's, until it reaches Crooked creek. These ridges are all overcome by cuts except one opposite the mouth of Allison's creek, where a tunnel of 600 feet is encountered. This division embraces the most serious difficulties on the line of the railroad. Besides the tunnel through the Blue Ridge and the 600 feet tunnel just mentioned, there are five others passing through the ridges making down from the Blue Ridge, and separating the head branches of the Catawba between the mountain tunnel and Allison's creek, whose circuit the line is compelled to make in order to gain distance for admissible grades. These tunnels are respectively 300, 260, 1300, 800, and 2200 feet in length, making in the aggregate including the main tunnel, and the tunnel at the mouth of Allison's creek, 13,360 feet of subterraneous road. For further details in relation to this important division of the road, I beg leave to refer to the maps numbered 7, 8 and 9, and to the profiles, and to the tables of grades, curvature, distance, and elevations thereto annexed.

From an inspection of the maps, the topography would seem to indicate Mill Creek, or the slopes of Big Ridge between Catawba and Allison's Creeks as the route of the railroad, but the elevation of the line at the heads of those creeks is so great that the directness of their course which so immediately points to them as the route for the

road, forms in this case, their main objection, for the reason that they do not afford sufficient distance for available grades. To obviate this difficulty, it became necessary to make the detour to the south, as beforementioned, and tunnel through Big Ridge, as laid down on the map. In farther examinations preparatory to a final location, it may be found that the tunnel, 2200 feet long through the Big Ridge, may be somewhat shortened by crossing the ridge a little higher up. It is also believed that the tunnel through the Blue Ridge may be reduced in length, and that the whole line is susceptible of improvement in all its most objectionable features.

The estimated cost of this section is \$3,079,265.

III.—PIEDMONT SECTION.

From the mouth of Crooked Creek to the mouth of Ward's Branch, 37 miles.

With the view of cutting off the bends of the Catawba, this section of the railroad was carried across the country, passing through Marion and near Marganton. The uniform character of the high and numerous ridges, of which Snowhill is the principal, which cross the line, establishes the fact, of which I entertained but little doubt before running the line, that the road must of necessity conform to the valley of the Catawba. Nevertheless, an estimate of the line, as run, has been prepared, and the accompanying maps numbered 9, 10, 11, 12 and 13, together with the profiles and tabular statements will show its direction and character.

In lieu of the estimate on this line, however, I propose substituting an estimate of the cost of the valley route, predicated upon a portion actually surveyed, and a comparison therewith of the remainder not instrumentally examined. In this way I make the cost of this division of the road \$886,449.

IV.—EASTERN SECTION,

From the mouth of Ward's Branch to the termination of the railroad, 71.¹/₁₀ miles.

This section follows the valley of the Catawba river to a sudden bend at Long Shoal, about two miles above Oxford's Ford, where the line crosses the river and continues in the valley to Island Creek, up which it ascends, crossing on the way three prongs of Elk Shoal Creek to Norton Ridge, which divides the waters of the Yadkin from those of the Catawba, then along this ridge to the North Carolina Railroad, near Mrs. Partee's, and thence along the North Carolina Railroad to Salisbury. Maps number 13, 14, 15, 16, 17, 18, 19, 20, 21 and 22, the tables and profiles show the direction and characteristics of the line. The route, however, which will probably, upon farther examination, prove to be the best and most direct to Salisbury, will leave the line just described in the vicinity of St. Michael's church, thence along the ridge, dividing Third and Withrow's creeks, and thence across Grant's creek to the town of Salisbury. I also suggest for future examinations, a line leaving the valley of the Catawba at the mouth of Horse Ford creek, ascending along Spring branch to Buffalo creek, thence down this creek to its mouth, thence across the Catawba river at Buffalo Shoals, thence up the valley of a small stream to a union with the line first described near Kyle's crossroad, and thence following it to Salisbury. The chief objection to this line will be the grades encountered in crossing the bend of the Catawba, between Horse Ford and Buffalo creeks, its length will be about the same as that terminating at Mrs. Partee's, and the variation in cost, if any, will be so inconsiderable, that the estimate of the line to Mrs. Partee's which is \$1,428,230, may be assumed as the cost of the other.

Summary of the cost of the Swananoa Gap route
 186.⁷⁸/₁₀₀ miles long.

Western Section—For excavation, embankment, bridge and other masonry, and bridge superstructure, roadway superstructure, engineering and general administration, warehouses, water stations, land damages and overseers' houses,

	\$1,139,920
<i>Mountain Division</i> , for do.	3,079,265
<i>Piedmont Division</i> , for do.	886,448
<i>Eastern Division</i> , for do.	1,428,230
Repair shops & warehouses at the termini of the road,	150,000
Locomotives, 30, at \$9,500,	285,000
Passenger coaches, 20, at \$2,500,	50,000
Baggage cars, 10, at \$1,600,	16,000
Freight cars, 500, at \$650,	322,000
Gravel cars, 100, at \$260,	26,000

Total cost,	\$7,382,863
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Startling as this aggregate may seem to persons unaccustomed to contemplating enterprises of such magnitude, nevertheless, it is certain that with but one exception the great Alleghany range has no where been penetrated by a railroad at so small an expenditure.

The above estimate embraces every item of expenditure that is likely to occur, and is carried out in all its details on the most liberal scale, believing it to be better for the interests of the State that I should over estimate than under estimate the work. The present high price of labor and provisions is assumed as the basis. The tunnels are estimated at twenty per cent. more than the most difficult tunnels in the country have cost—the superstructure of the road at \$8500 per mile, and eight per cent. added for turnouts; for engineering expenses and general superintendence, I have allowed \$1000 per mile, \$45,000 for land damages, for warehouses, overseers' houses and water stations, \$300 per mile, and \$150,000 in

addition for machine shops and warehouses at the termini of the road; to the estimate for excavation, embankment and masonry, I have added 20 per cent. to cover a possible under estimate of the amount of rock excavation and unforeseen difficulties in obtaining foundations. And I find from a report published since I prepared my estimate for equipments or "rolling stock," that I have allowed for 10 locomotives, 4 passenger coaches, 150 freight cars and 100 gravel cars over and above what is estimated for on one of the most important roads in Virginia, now drawing fast to completion, on which receipts to the amount of \$1,235,657 are anticipated.

It will not, of course, be expected that an exact estimate can be made of the cost of a railroad passing through such a country as that above described, from preliminary examinations and experimental surveys alone. From as careful a calculation, however, as I am able to make from existing data, aided by a knowledge of the cost of similar works in a similar country, I feel no hesitation in expressing the belief that the road can be built with a single track of heavy iron rail, and equipped within the sum aboved named.

The mountain section opposes the only difficulties worthy of consideration, as has been before observed. On this section seven tunnels occur, and between the spurs which divide the branches of the Catawba, high embankments are encountered, which tend greatly to swell the cost of the work. The line is, however, practicable both as regards curves and grades, which in the passage of the Blue Ridge, is a matter of paramount consideration. The cost, whilst it is an important desideratum, yet, regarding the object to be attained, may be viewed as secondary. Such at least has been the view taken in other portions of the country, judging from the enormous amounts, (greatly exceeding our estimate) which have been expended in surmounting the Blue

Ridge, to accomplish objects not greater than those which we expect to achieve here. In the ascent eastward the locomotive is not taxed beyond its power; on the hundred feet grades westward across the mountain it may be necessary sometimes to duplicate its power by the employment of an additional locomotive. This is however done on the Baltimore and Ohio Railroad, and on every railroad in the country crossing the Alleghany Mountains, except one.

The valleys of the French Board, Swananoa and Catawba afford no difficulties of a formidable nature; the bends which require abrupt curvature, and the cliffs which extend to the water's edge, may be regarded rather as exceptions to the generally favorable nature of their valleys, than as characterizing them as remarkable for the obstacles which they would oppose to the construction of a railroad.

THE WATAUGA GAP ROUTE.

The first step taken in the survey of this route was to test the availability of the country drained by the tributaries of John's river for the eastern descent of the Blue Ridge. With this view three depressions were selected for the passage of the mountain; one at the head of the south prong of John's river, one at the head of Middle Fork, and one at the head of Nat's Cave Creek. The ascent from the westward to the first depression was made from the State line through the Watauga and Moody's Mill Creek, one of the head waters of the Watauga river, and the approach to the second and third depressions was made by the valley of Boon Fork of Watauga as a common route to both, to a point about a mile from each depression, whence the two summits are attained by lines branching off at an angle of degrees with each other. The routes being thus established from the State line to the heads of the three prongs of John's river above mentioned, a line of levels was next run from the head of

Middle Fork following in the direction of the country road to Mr. Carrol Moore's, a distance of seven miles from the summit. The fall to the foot of the mountain, four miles from the summit, was found to be 1959 feet, and to Mr. Moore's 2122 feet. The width of the mountain at the points assumed for the crossing, ascertained by a crest line of levels to be the lowest depression is so great, that the elevation cannot be reduced so as to bring the grades within the capacity of the locomotive. Assuming the levels of the tunnels at 1722 feet, the tunnel at the head of South prong of John's river would be 10,700 feet, at the head of Middle Fork 12,500 feet, and to open into the North prong or Nat's Cave Creek, the tunnel would be 7920 feet in length. By following the side of the mountain which is serrated by a succession of elevated spurs that would require frequent short tunnels and render heavy embankments necessary in passing from one to the other, about eight and a half miles would be obtained from the eastern portals of the tunnels to Mr. Moore's, which would give a grade of 202 feet to the mile, supposing it practicable to obtain a uniform grade. The grades therefor being so great as to render a resort to stationary power necessary. I considered the route by the waters of John's river, heading in the cove between the Grandfather and the Blowing Rock mountains, as impracticable.

A table marked (A) in the appendix exhibits the levels, distances, &c., of all the prominent points from the State line to the valley of John's river.

Being cut off from an approach to the mountain by the valleys of the tributaries of John's river, heading in the Grandfather mountain, a high and elevated peak, which deprives the Blue Ridge of its name in the vicinity and field of our operations—my attention was directed to the valley of the Yadkin, and a line was run from the eastern portal of the tunnel at the head of Nat's Cave

Creek, to the Blowing Rock Ridge, encountering on the way, in a distance of four miles, four tunnels of an aggregate length of 3,100 feet, and embankments ranging as high as 75 feet—penetrating Blowing Rock Ridge, by a tunnel 4,100 feet long, 661 feet below the summit—the line falls into the waters of the Yadkin at the head of Bently Camp Branch, thence along the valley of this stream half a mile, thence by a very circuitous route on the mountain slopes, crossing several high ridges, two of which will have to be tunnelled, it strikes the main branch of the Yadkin near Mr. Isaac Story's, thence making a deflection to the right; it descends on the slopes of the ridge between the main Yadkin branch and Dennis branch, $4\frac{1}{8}$ miles from Blowing Rock tunnel—on reaching Dennis branch, the line was found to be elevated 400 feet above its valley, and the ground falling so fast on the opposite side, that although some distance might be gained by making a detour around the head of the creek, yet the grade could not be sustained. This line was therefore abandoned. Attention was now directed to the practicability of turning Blowing Rock Ridge, by a line on its southern slope, and passing through it at a low gap, meander around the head branches of Mulberry Creek, which makes into John's River, thence through Chesnut Mountain at the Mulberry Gap—pass over upon the branches of the Yadkin, and so gain distance for the descent. But finding the season drawing fast to a close, and the appropriation for the survey inadequate to the organization of another party, indeed already consumed in the elaborate surveys that had been made on this route, it was determined to make the descent to the Yadkin on a line, intermediate to the last mentioned line, (which will be again prominently adverted to,) and the trial line to Dennis branch above mentioned. Returning then to the Blowing Rock tunnel, a line was traced thence down Bently

Camp branch to its confluence with the Yadkin—distance $2\frac{87}{100}$ miles, and fall 895 feet, thence it follows the low grounds of this stream for 5 miles, and makes a descent of 330 feet, thence assuming a grade of 105 feet per mile, the line descends alternately along the slopes of Fork Mountain and Buffalo Ridge, until the low grounds of the Yadkin are reached by this grade in a distance of $3\frac{71}{100}$ miles, in this distance the Yadkin river is crossed six times by bridges of 200 feet span each, and the excavation and embankment will be very heavy.—At the foot of the 105 feet grade, the line again crosses the Yadkin river, and following close to the turnpike for a short distance, strikes through the low grounds, and again crosses the river, it then descends along the slopes of Rip-Shin Mountain, in close proximity to the river, until it arrives at a point opposite Patterson. The grades in this distance are 60 and 22 feet per mile, the course of the line very direct without much curvature, and the work light. The line continues in the valley of the Yadkin, one mile below Patterson, to the mouth of Warrior Branch, thence up that branch $1\frac{5}{10}$ miles, thence passing through the Warrior Mountain by a tunnel 1,100 feet long, thence descends along a branch of Lower Creek, to within about a mile and a half of the village of Lenoir, thence it crosses a ridge to another prong of Lenoir Creek, which it descends for a short distance; thence ascends to the summit of the ridge which divides the waters of Lower and Gunpowder Creeks, and passing through this ridge by a tunnel 800 feet in length, it falls into a branch of Gunpowder Creek, along which it descends $1\frac{25}{100}$ miles, it then ascends, passes over a ridge to the main branch of Gunpowder Creek, which it crosses and immediately overcoming another ridge, enters upon the waters of the Catawba, in the vicinity of Horse Ford Creek, where it unites with the Swananoa Gap route.

The road from Patterson to the Catawba will be toler-

ably direct, but with objectionable grades and very expensive.

Recurring now to the portion of the line between the Blowing Ridge and the Yadkin river, it will be perceived that the fall is 895 feet in a distance of $2\frac{87}{100}$ miles, or 311 feet to the mile. I have also shown by the line to Denis branch that this objectionable feature cannot be overcome by any line in that direction, or north of Bently Camp creek. If a line with practicable grades can be obtained—and whilst I have great doubt whether it can be at an admissible cost, I am not prepared to say that it cannot—we must look to the south of Bently Camp creek. For reasons heretofore stated, we were prevented from making the surveys as full as the intricacy of the country required. Between John's river and the Yadkin, where the line just described leaves the Yadkin, no portion of the State east of the Blue Ridge is so rugged and opposes so many difficulties to the construction of a railroad. The whole surface is diversified with high ridges and spurs dividing the various branches of the Catawba and Yadkin. To trace out the various routes which present themselves, and to arrive at anything like a correct conclusion as to the practicability of a railroad on this portion of the Watauga route, would require the unremitting labors of a party of engineers for a whole season. I would recommend a close examination and probably a survey, if farther examinations of the Watauga route should be deemed necessary, of Mulberry creek, a tributary of John's river, though owing to the great elevation of the summit level of the mountain, which is 813 feet higher than the Swananoa, I doubt whether any of the tributaries of John's river can be made available. Such being my views, derived from a knowledge of the character of the country, and from the elevation of points ascertained by offsets from the line down Bently Camp branch.

I have in the estimate, in preference to a total abandonment of the route, superseded the line which was surveyed and proved to be impracticable from the eastern portal of the Blue Ridge tunnel to a point $4\frac{1}{2}$ miles above Patterson, by the conjectural line before mentioned. This line, after meandering around the heads of Nat's Cave creek, enters the valley of Estis Branch: there are four tunnels on this portion of the line, viz: three 600 and one 500 feet in length, thence it runs down the slopes of Estis branch for a short distance, and bearing around through a low gap in the intervening ridge strikes around the head waters of a tributary of the above stream to a gap in the Blowing Rock ridge, passing through this by a tunnel 2600 feet long; thence meandering around the head waters of Mulberry creek, it descends along the slopes of the ridge, dividing Mulberry creek from the Yadkin, to the Mulberry Spring gap, passing through the gap by a tunnel $\frac{2}{3}$ of a mile long to Bently Camp branch, thence it crosses in succession Bently Camp, Town Site Ridge, the main branch of the Yadkin, a ridge between it and Dennis' branch, then Dennis' branch, thence it follows along the slopes of Buffalo Ridge until it intersects the surveyed line one mile above a point known as the narrows. The length of this line is 14 miles, and the grade will be $111\frac{4}{10}$ feet per mile; commencing at the foot of this grade the line descends for three miles at the rate of 105 feet, and thence to Patterson at from 60 to 22 feet per mile. The accompanying map will more particularly define this line. I have great doubts whether this line with the grade assumed, or with any uniform grade can be obtained. I apprehend on many parts it will be necessary to increase and vary the grade to a degree that will render the line impracticable.

Having now designated a line from the Eastern portal of the Blue Ridge tunnel to its junction with the Swanoa route at Horse Ford—no part of which however,

can be considered as arbitrary or fixed, not even the point of union with the Swananoa line. For upon a more full and thorough examination it may prove to be advisable, should a line by the Yadkin valley be obtained, to cut off the detour of Gunpowder creek, cross Brushy mountain and unite with the Swananoa line on Norton ridge. It now remains for me to notice more particularly, that portion of the route between the State line and the Eastern portal of the Blue Ridge tunnel, which will complete the Watauga Gap route. This portion of the route lies in the valleys of the Watauga and Boon Fork on the West of the mountain, and opens on the East into one of the head branches of Nat's Cave creek, by a tunnel through the Blue Ridge 7920 feet long. The Watauga is literally a mountain stream. In forcing its circuitous passage through the many ridges which are intersected by it, it is confined within very narrow limits, and with but few exceptions is bounded by steep, rugged and often precipitous cliffs. In Boon Fork, the slopes of the spurs in some places recede from the stream, and the ground offers greater facility for the construction of the road. Throughout this whole section, however, the road will be characterised by a succession of abrupt curves, steep grades, heavy excavations and embankments, and tunneling. In the valley of the Watauga, there are four tunnels, one 1200, one 650, one 500, and one 200 feet long.

RECAPITULATION OF THE WATAUGA ROUTE.

Sec. 1. From the State line to the Eastern portal of the tunnel through the Blue Ridge $22.\frac{5}{10}$ miles (surveyed) cost, \$2,007,737

2. From the Eastern portal of the Blue Ridge tunnel to a point $4\frac{1}{4}$ miles East of Patterson, 14 miles (conjectural line) cost, \$1,890,750

3. From a point $4\frac{1}{4}$ miles East of Patterson to the Horse Ford $27.\frac{87}{100}$ miles (surveyed) cost, \$1,336,205

4. From the Horse Ford to Salisbury $57.\frac{4}{10}$ miles (surveyed) cost, \$1,067,341

Total length $121.\frac{77}{100}$ miles, and cost, \$6,304,033
exclusive of equipments, machine shops, and warehouses, at the termini, the addition of which would make the entire cost, \$7,153,034

Comparison of the Watauga and Swananoa routes.

1. The summit level of the Blue Ridge on the Watauga route is 813 feet higher than on the Swananoa route.

2. There are nine summits or undulations more on the Watauga route.

3. The elevation of all the summits on the Watauga route amounts to 1280 feet more than on the Swananoa route.

4. The ascent eastward is 380 feet, and ascent westward is 1276 feet greater than on the Watauga route.

5. The grades ascending eastward are 94 and $98.\frac{73}{100}$ feet per mile on the Watauga, against 68 on the Swananoa route.

6. The ascent westward on the Watauga route is effect-

ed on grades of $114.\frac{4}{10}$ feet per mile, for 14 continuous miles, immediately succeeded by a grade of 105 ft. per mile for a distance of three miles, while on the Swananoa route the ascent does not exceed 100 feet per mile, occurring at three places on grades $4.\frac{45}{100}$ $\frac{66}{100}$ and 4 miles in length with moderate grades intervening.

7. The curvature is greater in amount on the Watauga route.

8. There is a greater length of bridging on the Watauga route.

9. There are 9110 feet more tunnelling on the Watauga than on the Swananoa route.

10. There is a much greater amount of heavy excavations and embankments on the steep mountain slopes on the Watauga route.

11. The Watauga route is $64\frac{93}{100}$ miles shorter, and costs \$229,830 less than the Swananoa route.

From these comparisons, it results in every essential characteristic, except in cost and measure distance, the Swananoa is superior to the Watauga route. But advantage in cost is counterbalanced in the greater expense of "working" the Watauga route, and the difference in actual distance is more than compensated by the usual computation of heights equivalent to distance applied to the greater elevation to be overcome on the Watauga route. Therefore, with the data before me, I feel constrained to give the preference to the Swananoa route, and I have no doubt that it will prove to be the most practicable route for a railroad from Salisbury to the Tennessee line. In arriving at this conclusion, I have not permitted myself to wander from a strictly professional consideration of the subject. I could name other considerations which might influence those whose province it may be to take a wider range, and a more extended view, but will confine myself to calling attention to a single fact and leave others to weigh and attach whatever importance it may be entitled to.

allude to the saving in transportation which will be effected by the Swananoa route over the East Tennessee and Virginia Railroad, looking to the extension of a railroad into Kentucky through the Cumberland Gap. The friends of this scheme contemplate, as I understand, forming a connection with the East Tennessee and Virginia Railroad somewhere in the vicinity of Greenville, to which point it is most probable the North Carolina and Western Railroad will be extended. Now should this road be carried by the Swananoa route, the Cumberland Gap road would be in the almost direct line of its prolongation; but should the Watauga route be taken, the trade and travel from the Cumberland Gap road would have to make a circuit of 70 miles over the East Tennessee and Virginia Railroad, which in measured distance, would more than counterbalance the difference in distance between the Swananoa and Watauga routes. This statement will be found in a communication of one of the engineers of that road, addressed to the "Executive Board of the Atlantic, Tennessee and Ohio Railroad."

It was my intention during the past summer to have reconnoitered a route between Ashville and Chattanooga, passing through Henderson, Haywood, Jackson, Macon, and Cherokee counties, but much to my regret and mortification, the time I designed appropriating to this object was lost by sickness.

Though the appropriation did not admit of as extensive and minute surveys as could have been desired, enough has been done to establish beyond all doubt, the practicability of a railroad across the Blue Ridge, and that too, at a moderate cost, in proportion to the magnitude and importance of the object.

I do not feel myself called upon to estimate the income of the road. The sources of its income must of course depend upon the amount of the transportation of freight and the number of passengers. Neither of these can be accurately ascertained at this time, but if we look at the

fertility and varied resources of the country through which the road passes, and to its extension to the East Tennessee and Virginia Railroad which communicates with the Mississippi river, and the Georgia, Alabama, and Tennessee Railroads, all must admit that a very large trade and travel may be calculated upon, and as a mere matter of dollars and cents, the road must be highly productive to the owners of the stock.

But in the benefits of this work, the State will be the chief participator. For regarding the improvement apart from the question of profit to the company, who can doubt that, if carried to completion, it will reimburse its cost many times over, in the activity and vigor it would give to the trade of her tidewater cities, in the extension of her foreign and internal commerce, in the increase of her agricultural and mineral productions consequent upon the cheapness of transportation, in the rise of real estate, and in turning the tide of emigration from the western and southwestern States into her own beautiful and fertile, but sparsely settled mountain regions, and filling them with towns and cities, and a busy and thriving population!

Whoever would go into a calculation of the amount which would be saved to the public, the business and industrious classes of the community, by the construction of this road, would be astonished at the result.

The character of the State (and as a citizen I say it with pride,) is prudent and deliberative, but let her not deliberate too long. Farther delay in the execution of this work will prove highly detrimental, if not fatal to the great interests of the State; it must result in the surrender of the control of her trade and commerce to the neighboring States, in an abandonment of the whole system of internal improvements, and cannot but prove highly injurious to existing improvements, and place the State in a condition of dependence, from which she can never recover. A wise and just regard to her own prosperity,

a generous sentiment of public and expansive utility, her *present* manufactures and commerce—her *future* great and permanent prosperity—the impulse of honor, and of honorable competition with her sister States, the sagacious calculations of a wise and liberal policy, the dictates of a rational self-interest, patriotism and State-pride, all unite in calling upon the State to embark in this enterprise, and to move immediately in the grand work of improvement. It must be evident to every one, that this work, if built at all, must be built mainly by the State.—It were a mockery for the State to ask the country, immediately interested, to make this improvement, or any large subscription thereto; she well knows that the wealth there, particularly in the mountain region, for want of an outlet, such as is now proposed, is not to be found in stocks, nor great pecuniary aggregates. It consists in lands, houses and labour, diffused through thousands of feeble veins, none of which can part with much without embarrassment. The slender surplus, in many instances, amounts to but little more than the taxes which pass into the coffers of the State. Will she, therefore, withhold the aid necessary for the rapid progress and speedy completion of a work, in which her honor, her rank in the Union, and the prosperity of her citizens are so deeply involved?

In conclusion it remains for me to say that I am much indebted to the unwearied exertions of Mr. W. A. Kuper, and Mr. J. C. Turner, on whom devolved the responsibility of directing the parties in the field, which duty they performed with intelligence and fidelity.

I have the honor to be

Your Excellency's most

Obedient servant,

WALTER GWYNN, *Chief Engineer.*

(A.) WESTERN DIVISION.—SWANANOA ROUTE.

STATEMENT of the number of Bridges from Flat Creek down the Swananoa and French Broad Rivers.

NAME OF RIVER OR CREEK.	No. of Station.	Span of Bridge.	Height of Abutmt.	Width of Stream.	Charact'r of Foundat'n	Charact'r of Bridge.	Abutmt's Grade.	REMARKS.
Flat Creek,	2253	feet. 30	feet. 25	feet. 25	gravel.	lattice.	feet.	To pass two streams.
McMakin Creek,	2569	25	27 0	8	soft.			
Whitson's Saw-mill Creek,	2690	10	30 5	8				Arch Culvert.
Swananoa River,	2712	100	20 0	75	rock.	lattice.	5	
Patton's Creek,	2802	10	14 0	8	"		3	
Roberts' Creek,	2980	10	10 5	5			3	
French Broad River,	3092	500	14 0	492	"	lattice.	5	Oblique.
Bruce's Creek,	3193	12	8 0	8	"			Open Culvert.
Lee's Mill Creek,	3572	12	8 0	8	"			"
New Found Creek,	3415	40	10 0	37	"	lattice.	5	
Lost Creek,	3529	20	10 5	15	"		3	
Deaver's Creek,	3694	8	4 5	6	"			Open Culvert.
Sandy Marsh,	3845	100	13 0	220	"	lattice.	5	Oblique.

Marshall Island,	4179	20	13	0	141	rock.		3	
Baley's Branch,	4236	12	10	5	12	"		3	
Bear Creek,	4287	12	14	5	10	gravel.		3	
Little Pine Creek,	4329	40	9	0	55	rock.	lattice.	5	
Pan-Pan Creek,	4416	6	17	0	10	"			Open Culvert.
Johnson's Cove Creek,	4519	12	12	0	10	"		3	
Big Pine Creek,	4555	40	12	0	65	"	lattice.	5	
Doe Creek,	4696	20	14	0	10	"		3	
Raccoon Branch,	4831	8	5	0	6	"			
Mountain Island,	4880	15	1	0	8	"		3	
Warm Spring Creek,	4991	100	12	0	70	"	lattice.	5	
Shut-in Creek,	141	50	8	0	40	"		5	
Grass Creek,	221	15	10	0	10	"		3	

WESTERN DIVISION.—SWANANOA ROUTE.

Table of Grades beginning at the Tennessee line and ending at the mouth of Flat Creek.

From Station.	To Station.	FEET.			GRADE.		Total Elevation.	REMARKS.
		Distance.	Rise.	Fall.	Per 100 ft.	Per Mile.		
276	220	5,600	8		.14	7.4	958.0	276 is at Tennessee line.
220	160	6,000	15		.25	13.2	973.0	Near Col. Fagg's.
160	140	2,000		00		00	973.0	
140	65	7,500	27		.36	19.0	1,000	
65	0 or 5,038	6,500				00	1,000	
5,038	5,020	1,800	3.5		.20	10.5	1,003.5	
5,020	4,990	3,000	16.2		.54	28.5	1,019.7	
4,990	4,940	5,000	15.0		.30	15.8	1,034.7	Opposite Warm Springs.
4,940	4,924	1,600					1,034.7	
4,924	4,899	2,500	20		.80	42.3	1,054.7	
4,899	4,889	1,000	0.5		.05	2.9	1,055.2	
4,889	4,839	5,000	22.8		.45	30.0	1,078.0	Opposite Mountain Island.
4,839	4,803	3,600	4.6		.13	6.8	1,082.6	
4,803	4,753	5,000	36.0		.72	38.0	1,118.6	Opposite Mr. Farsenworth.

Opposite Mrs. McCandles.

4,753	3,700	26.0	70	37.0	1,144.5
4,716	1,600	8.0	.50	26.4	1,152.5
4,700	2,500	2.5	.10	5.3	1,155.0
4,675	5,500	44.0	.97	51.2	1,199.0
4,620	6,200	18.6	.30	15.8	1,217.6
4,558	2,800	12.0	.43	22.7	1,229.6
4,530	6,000	18.4	.46	24.3	1,248.0
4,470	5,000	18.4	.37	19.5	1,260.4
4,420	9,400	21.6	.23	12.1	1,282.0
4,326	10,200	25.2	.25	13.0	1,307.2
4,224	3,200	17.3	.54	28.5	1,324.5
4,192	2,200	5.0	.23	12.1	1,329.5
4,170	4,000	16.0	.40	12.1	1,345.5
4,130	8,000	20.0	.25	13.2	1,365.5
4,050	6,000	14.5	.24	12.7	1,380.0
3,990	3,000	13.0	.43	22.7	1,393.0
3,960	6,000	12.0	.30	15.8	1,405.0
3,900	2,000	4.0	.20	10.6	1,409.0
3,880	10,000	15.0	.15	8.0	1,424.0
3,780	16,000	40.0	.25	13.2	1,464.0
3,620	4,400	18.0	.41	21.6	1,482.0
3,576	3,200	16.0	.50	26.4	1,498.0
3,544	5,100	41.0	.80	42.2	1,539.0
3,493	5,000	17.0	.34	18.0	1,556.0

On Marshall Island.

(Continued on next page.)

WESTERN DIVISION.—Table of Grades Continued.

Fm. Sta'n	To Station.	FEET.		GRADE. Per 100 ft Per mile.	Total Elev'n.	REMARKS.
		Distance.	Rise.			
3,443	3,343	10,000	40.0	.40	1,596.0	Crossing French Broad.
3,343	3,303	4,000	18.0	.45	1,614.0	
3,303	3,258	4,500	18.0	.40	1,632.0	
3,258	3,158	10,000	18.0	.18	1,650.0	
3,158	3,090	6,800	8.0	.12	1,658.0	
3,090	3,042	4,800	12.0	.25	1,670.0	Smith's Bridge. Junction of F. B. & S. River.
3,042	3,018	2,400		.06	1,670.0	
3,018	2,968	5,000	3.0		1,673.0	
2,968	2,936	3,200			1,682.8	Cross Swananoa River. 40 stations to summit of Gap.
2,936	2,870	6,600	9.8	.15	1,710.0	
2,870	2,734	13,600	27.2	.20	1,756.0	
2,734	2,679	5,500	46.0	1.15	1,737.0	
2,679	2,641	3,800		.50	1,741.0	
2,641	2,603	3,800	4.0	.10	1,759.0	Mouth of Gudger's Branch.
2,603	2,570	3,300	18.0	.55	1,945.0	
2,570	2,426	14,400	186.0	1.29	1,945.0	
2,426	2,425	100			1,903.0	
2,425	2,365	6,000		.70	1,949.0	
2,365	2,319	4,600	46.0	1.00	1,949.0	Flat Creek.
2,319	2,310	900			1,925.0	
2,310	2,280	3,000		.80	1,940.0	
2,280	2,250	3,000	15.0	.50		

WESTERN DIVISION.—SWANANOA ROUTE.

Abstract of Grades, showing the length of each variety of ascending, descending, and level grades from the Tennessee line to the junction of Swananoa River and Flat Creek.

Level Grade.	Under 10 feet per mile.	BETWEEN.					
		10 and 20 feet per mile.	20 and 30 feet per mile.	30 and 40 feet per mile.	40 and 50 feet per mile.	50 and 60 feet per mile.	60 and 70 feet per mile.
2,000	5,600	6,000	3,000	5,000	2,500	5,500	5,500
6,500	1,000	7,500	5,000	3,700	5,100	4,600	14,400
1,600	3,600	1,800	1,600	6,000	3,000		
2,400	2,500	5,000	2,800				
3,200	10,000	6,200	6,000				
100	10,000	5,000	3,200				
900	6,800	9,400	4,000				
	6,600	10,200	3,000				
	3,800	2,200	4,400				
	5,000	8,000	3,200				
		6,000	10,000				
		6,000	4,000				
		2,000	4,500				
		16,000	3,800				
		5,000	3,300				
		4,800	3,000				
		13,600					
16,700	54,900	114,700	64,800	14,700	10,600	10,100	19,900

From the Tennessee line to junction of the French Broad and Swananoa Rivers, 45 miles. From junction to the mouth Flat Creek, 13 miles. Total distance from Tennessee to Flat Creek, 58 miles.

Total rise in 52.4 miles, 1,075 feet. }
 " fall in 2.4, 85 feet. } From Tennessee line
 " Level grade, 3.2, } to mouth Flat Creek.

Average ascent for 52.4 miles, is 20.5 feet per mile.

" descent for 2.4 " 35.0 " "

(C.) WESTERN DIVISION.—SWANANOA ROUTE.

Tabular arrangement showing the distances and levels of all the prominent points from the State line at Paint Rock to the mouth of Flat Creek.

NAMES OF PLACES.	Inter'ate distances in Miles	Total dis fm State line. and Feet.	L's, gd'e ab'e tide. Feet.	Lv's gr'd ab'e tides. Feet.	Total Ascent. Feet.	Total De'ct. Feet.	REMARKS.
Tennessee line,	0.	0.	1,269.4	1,264.0			
Warm Springs,	6.720	6.720	1,329.0	1,325.0	61.0		Opp'te High Rock Bluff.
Mountain Island,	2.40	8.760	1,377.4	1,364.0	100.0		1 mile east Mrs. Candler's.
Rocky Bend,	4.2880	12.3640	1,449.0	1,446.0	182.0		County town of Madison.
Chunn's Bridge,	6.120	18.3760	1,601.0	1,601.0	337.0		Opp. F. B. P. O. and resi- dence of Mr. Alexander.
Town of Marshall,	2.5040	21.3520	1,649.0	1,647.0	383.0		
Mouth of Ivy,	2.3440	24.1680	1,690.0	1,684.0	420.0		
Alexander's Bridge,	8.1860	32.3540	1,796.0	1,796.0	532.0		
Gorman's Bridge,	6.4320	39.2580	1,951.0	1,952.0	688.0		
Crossing French Broad River.	2.3040	42.340	1,977.0	1,964.0	700.0		
Junction of Swananoa & F. B. R.	3.60	45.400	1,993.0	1,989.0	725.0		1 1/4 mi's fm Ash'e't's Gre'e
Asheville Plank Road,	1.1320	46.1720	2,003.0	1,999.0	735.0		Near Mr. Gudger's house.
Foot of 68 feet grade,	5.3400	51.5120	2,079.0	2,066.0	802.0		Cut'g bend of Swan'a R'r
Summit of 68 feet grade,	2.4140	54.3980	2,264.0	2,304.0	1,040.0		End of Western Division.
Mouth of Flat Creek,	3.1460	58.160	2,258.0	2,251.0	53.0		

D.

MOUNTAIN DIVISION—SWANANOA ROUTE.

TABLE of Grades, beginning at the junction of Flat Creek and Swananoa River, and ending at mouth of Crooked Creek.

Form Sta.	To Sta.	Feet.		Grade.		Total Elevation.	Remarks.
		Dist.	Rise. Fall.	Per 100 ft.	Per Mile.		
0	70	7000	35	.50	26.4	1974	Near West Mouth Tunnel.
70	105	3500	36	.97	51.2	2010	
105	150	4500	44	1.00	52.8	2054	
150	180	3000	15	.50	26.4	2069	
180	290	5000	66	1.30	68.6	2135	
230	238	800				2135	
238	473	23500		1.90	100.0	1688	
473	501	2800	447	1.00	52.8	1661	
501	516	1500	27			1660.5	
516	536	2000	28	1.40	74.0	1632.5	
536	590	5400				1632	Head of Catawba.
590	622	3200	60	1.90	100.0	1572	
622	633	1100				1572	

MOUNTAIN DIVISION.—Table of Grades Continued.

From Sta.	To Sta.	Feet.		Grade.		Total Elevation.	REMARKS.
		Dist.	Rise.	Fall.	Per 100 ft.	Per Mile.	
633	846	21300		405	1.90	100.0	Moffit's Branch.
846	849	300					
849	865	1600	7.5		0.47	22.6	
865	922	5700		91.5	1.60	84.5	Opposite Gen. Bergin's.
922	980	5800		29	.50	26.4	
980	1015	3500		11	.31	16.4	
1015	1035	2000	13		.60	32.0	
1035	1082	4700		33	.70	37.0	
1082	1092	1000					Crooked Creek.

MOUNTAIN DIVISION.—SWANANOA ROUTE.

STATEMENT of the number of Bridges, beginning at Flat Creek and ending at Crooked Creek.

NAME OF RIVER OR CREEK.	No. of Station.	Span of Bridge.	Height of Abutment	Width of Stream.	Character of Foundation	Character of Bridge.	Abutment Grade.	REMARKS.
Flat Creek,	169	20	13	16	gravel.	girder.		Old channel filled.
Young's Creek,	503	20	10	10	rock.	"		Nat. Abut. on one side.
Clover Branch,	570	20	35	10	"	"		
Chesnut Fork,	583	30	42	10	"	"		
Fortune's Creek,	587	30		25	"			Natural Abutments.
Allison's Creek,	622			15				162 feet below grade.
Moffit's Branch,	847	50	47	10		lattice.		For roadway also.
Gilleland's Creek,	1027	25	22	10	soft.	girder.		
Crooked Creek,	1092	100	18	80		lattice.		Rock on one side.

MOUNTAIN DIVISION.—SWANANOA ROUTE.

ABSTRACT OF GRADES, showing the length of each variety of ascending, descending and level grade on the Mountain Division, beginning at Flat Creek and ending at Crooked Creek.

Grade. Level	Under 10 feet per mile.	Between 10 and 20 ft. per mile.	Between 20 and 30 ft. per mile.	Between 30 and 40 ft. per mile.	Between 40 and 50 ft. per mile.	Between 50 and 60 ft. per mile.	Between 60 and 70 ft. per mile.	Between 70 and 80 ft. per mile.	Between 80 and 90 ft. per mile.	Between 90 and 100 ft. per mile.
Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
800		3500	7000			3500	5000	2000	5700	23,500
1500			3000			4500				3200
5400			1600			2800				21,300
1100			5800							
300				2000						
1000				4700						
10,100		3500	17,400	6700		10,800	5000	2000	5700	48,000

MOUNTAIN DIVISION.—SWANANOA ROUTE.

TABULAR ARRANGEMENT, showing the Distances and Levels of all the prominent points from the State line, beginning at the end of 58 miles, or end of West River, and extending to the valley of the Catawba, at crooked Creek.

NAMES OF PLACES.	Interm'dt Distances	Total Dis- from State line.	Grade Levels above Tide.	Ground Level above Tide.	Tot'l		REMARKS.
					As't	Des.	
	In Miles	and Feet	feet.	feet.	feet.	feet.	
Mouth of Flat Creek,		58.160	2258.0	2251.0	1075	85	Beginning Mount. Div.
Summit of Swananoa Gap,	5.3600	63.3760	2337.0	2657.0	1276	207	Tunnel 7900 ft. long.
Bear Pass Tunnel,	1.3120	65.1600	2227.0	2355.0		368	Tunnel 300 ft. long.
Sugar Loaf Ridge,	0.2600	65.4200	2125.0	2230.0		418	Tunnel 260 ft. long.
Ridge bet'n Mill Creek & Catawba,	0.4600	66.3520	2040.0	2269.0		503	Tunnel 1300 ft. long.
Old State Road Ridge,	1.4720	68.2960	1952.0	2076.0		591	Tunnel 800 ft. long.
Falls of the Catawba,	0.3100	69.780	1951.0	1941.0		591	
Summit of Big Ridge,	0.1300	69.1880	1936.0	2584.0		611	Tunnel 2200 ft. long.
Allison's Creek,	0.2200	69.4280	1891.0	1728.0		652	
Allison's Tunnel,	1.2320	71.1320	1768.0	1913.0		775	Tunnel 600 ft. long.
Moffit's Creek,	2.4240	74.280	1486.0	1439.0		1057	Foot of max. Grade.
Crooked Creek,	4.3480	78.2760	1342.0	1324.0		1201	End of Mount. Div.

PIEDMONT DIVISION.—SWANANOA ROUTE.

TABLE of Grades, beginning at mouth of Crooked Creek, and ending at the mouth of Ward Creek.

From Sta.	To Sta.	Feet.		Grade.		Total Elevat'n	REMARKS.
		Dist.	Rise. Fall.	Per 100 ft.	Per Mile.		
1092	1150	5800	37.0	0.64	33.7	1060	
1150	1224	7400	95.0	1.30	68.0	1155	
1224	1234	1000		.50	26.4	1150	Osbon's Creek.
1234	1249	1500	15.0	1.00	52.8	1165	
1249	1274	2500		1.00	52.8	1140	Nick's Creek.
1274	1299	2500	25.0	1.00	52.8	1165	
1299	1333	3400	5.0	0.15	7.9	1170	
1333	1376	4300		1.50	79.0	1105	
1376	1378	200				1105	Little Nick's Creek.
1378	1408	3000	24.0	0.80	42.2	1129	
1408	1410	200				1129	
1410	1453	4300		1.00	52.8	1087	
1453	1476	2300				1087	Marion.
1476	1498	2200	20.0	0.95	50.0	1108	
1498	1499	100				1108	

1499	1549	1549	5000	48.0	0.96	50.7	1060
1549	1579	1579	3000	40.0	1.33	60.0	1020
1579	1585	1585	600				1020
1585	1605	1605	2000	20.0	1.00	52.8	1040
1605	1685	1685	8000	130.0	1.60	85.0	910
1685	1780	1780	9500	75.0	0.80	42.0	835
1780	1840	1840	6000	30.0	0.50	26.4	805
1840	1880	1880	4000				805
1880	1930	1930	5000	15.0	0.30	15.8	790
1930	1945	1945	1500	17.0	1.13	60.0	807
2208	2250	2250	4200	16.0	0.38	20.0	809
2250	2343	2343	9300	63.0	0.67	35.7	747
2343	2405	2405	6200				747
2405	2430	2430	2500	26.0	1.00	52.8	721
2430	2440	2440	1000				721
2440	2520	2520	8000	90.0	1.12	59.1	811
2520	2570	2570	5000	36.0	0.70	37.9	775
2570	2643	2643	7300	39.0	0.53	28.0	736
2643	2693	2693	5000				736
2693	2777	2777	8400	110.0	1.30	68.0	846
2777	2830	2830	5300	55.0	1.04	55.0	791
2830	2950	2950	12,000	114.0	.95	50.0	677

Ridge, head of Thompson's Fork.

B. Silver Creek.

Morganton.

Catawba River.

PIEDMONT DIVISION.—SWANANOA ROUTE.

Statement of the number of Bridges, beginning at Crooked Creek and ending at Ward's Branch, 35.2 miles.

NAMES OF RIVER OR CREEK.	No. of Station.	Span Bridge.	Height About Str'm.	Width of Foundation.	Character of Foundation.	Character of Bridge.	Abutment grade.	REMARKS.
Thompson's Fork,	1,696	20	30	10	Soft.	Girder		Muddy Creek.
"	1,740	20	25	10	"	"		
"	1,755	20	20	10	"	"		
"	1,826	25	20	12		"		
"	1,835	30	20	12		Lattice		
Main Muddy Creek,	1,945	100	40	50		"		
Silver Creek,	2,430	100	21	30		"		On one side rock.
Hunting Creek,	2,643	50	15	25		"		"
Long Branch,	2,690	20	20	6		"		Supposed rock.
Ward's "	2,922	30	25	20	Rock.	Girder		
"	2,930	30	25	20	"			
"	2,934	30	25	20	"			

PIEDMONT DIVISION.—SWANANOA ROUTE.

TABULAR ARRANGEMENT showing the Distances and Levels of all prominent points from the end of the Mountain Division and extending to the mouth of Ward's Branch on the Yadkin.

NAMES OF PLACES.	Inter- mediate distances. In Miles and Feet.	Total dis- tance from State Line.	Level Grade above Tide. Feet.	Level Gr'nd above Tide. Feet.	Total Ascent. Feet.	Total Descent. Feet.	REMARKS.
Mouth of Flat Creek,		78.3769	1342	1324			Beginnig of Piedmont Division.
Summit of ridge head Muddy cr'k,	3.4260	82.2740	1478	1542			
Town of Marion,	3.1360	85.4120	1406	1427			
Summit of Ridge,	2.3440	88.2280	1339	1392			Head of Thompson's Fork of Muddy creek
Muddy Creek,	6.2320	94.4600	1126	1081			
Summit of Snow Hill Ridge,	1.4720	96.4040	1264	1336			
Reedy Branch,	0.4500	97.3260	1236	1187			
Summit at head of Silver Creek,	0.4500	98.2480	1259	1314			
Silver Creek,	5.3100	104.0300	1040	1018			
Rutherford Road,	1.2820	105.3120	1120	1178			1 mile south of Mor- ganton.
Morganton and Statesville Road,	2.5040	108.2880	1054	1064			
Sum't bet. Long's & Ward's br'nchs	2.0440	110.3320	1165	1217			
Catawba Riv. mouth Ward's br'ch	3.1460	113.4780	974	996			End of Piedmont Div.

EASTERN DIVISION.—SWANANOA ROUTE.

Abstract of Grades, showing the length of each variety of Grades ascending, descending, and level on Eastern Division, beginning at Ward's Branch, and ending at the Central Railroad.

Level Grade. Feet.	Under 10 ft. per mile. Feet.	10 & 20 ft. per mile. Feet.	20 & 30 ft. per mile. Feet.	30 & 40 ft. per mile. Feet.	40 & 50 ft. per mile. Feet.	50 & 60 ft. per mile. Feet.	60 & 70 ft. per mile. Feet.	70 & 80 ft. per mile. Feet.	80 & 90 ft. per mile. Feet.	90 & 100 ft. per mile. Feet.
8,000	4,000	4,500	3,000	2,700	4,000	2,500	3,600			
5,100	7,000	3,000	2,800	6,800	6,000		6,100			
7,000	3,000	14,800	4,300	3,000	11,000					
4,500	4,900	3,500	2,500 ^{1/2}		4,400					
4,000	7,000	2,900	3,000		3,200					
4,000	4,400	3,000	2,000		3,500					
600	8,400	9,500	12,000		3,000					
23,000	3,900	2,000	1,200		4,400					
800	4,200	4,000	3,800							
100	5,800	9,300	2,000							
8,000	8,200	14,000								
12,000	5,000	4,000								
1,000	5,000	4,000								
200	4,300	15,000								
2,500		3,500								
2,700		15,000								
		4,000								
83,500	75,100	116,000	36,600	12,500	39,500	2,500	9,700			

EASTERN DIVISION.—SWANANOA ROUTE.

STATEMENT of the number of Bridges beginning at the mouth of Ward's Branch and ending at the Central Railroad—71.1 miles.

NAME OF RIVER OR CREEK.	No. of Station.	Span of Bridge.	Height of Abutment.	Width of Stream.	Charact'r of Foundat'n	Charact'r of Bridge.	REMARKS.
Shoal Creek,	3028	60	35	50	rock.	lattice.	
Bridge Creek,	3070	40	30	30		"	
Coldarse Creek,	3075	40	25	15		"	
Mill Creek,	3240	40	30	12	rock.	"	'Squire Glass'.
Jumping Gully,	3370	40	20	15	"	"	
Drowning Creek,	3524	100	25	55		"	
Pitt's Spring Branch,	3607	10	13	6		girder.	
Horse Ford Creek,	3681	75	25	40	rock.	lattice.	
Falling Creek,	3955	50	25	20		"	
Snow Creek,	4060	50	25	20	rock.	"	
Catawba River,	4200	650	18	625	"	"	
Lower Little River,	4430	120	35	67	"	"	

EASTERN DIVISION.—SWANANOA ROUTE.

Tabular Arrangement, showing the Distances and Levels of all prominent points from the State line, beginning at the end of 114 miles, or Piedmont Division, and extending to the Central Railroad.

NAMES OF PLACES.	Inter'm'te Distances in Miles	Total dis. fr'm State line. and Feet.	Gr'd line abv. tide.	Ground Level ab'v tide.	Total Ascent.	Total Descent	REMARKS.
Mouth of Ward's Branch,		113.4760	990.0	974.0			Begin'g of Eastern Division.
Love Lady Ford,	0.3900	114.3380	996.0	990.0		17.0	
Devil's Shoals Begin,	6.3120	121.1200	979.0	974.0		49.0	Surface of Water.
Drowning Creek,	3.2860	124.4080	950.0	929.0		73.0	"
Horse Ford Creek,	2.5140	127.3940	926.0	906.0		116.0	"
Catawba River,	9.4380	137.3040	893.0	875.0	10.0	127.0	
Oxford Ford Road,	1.3120	139.0880	883.0	876.0	"	"	
Lower Little River,	2.4040	141.4920	882.0	858.0	"	"	
Mouth of Island Creek,	1.0420	143.0160	895.0	888.0	19.0	"	Opposite its Mouth.
Summit,	1.3620	144.3780	978.0	1034.0	116.0	"	Between Elk Shoal Creek and Catawba.
Elk Shoal Creek,	2.0000	146.3780	967.0	929.0	136.0	181.0	
Brush Mountain Road,	1.3520	148.2020	1042.0	1040.0	231.0	237.	
Statesville & Morganton Rd	4.3480	153.0160	1024.0	1036.0	252.0	296.0	About 3 miles East of Buffa-
Buffalo Shoal Road,	5.0200	158.0360	968.0	964.0	256.0	296.0	lo Shoal Ford.
St. Michael's Church,	5.2800	163.3160	911.0	919.0	267.0	367.0	

EASTERN DIVISION.—(Tabular Arrangement Continued.)

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NAMES OF PLACES.	Interm'te Distances in Miles and Feet.		Gr'd line abv. tide.	Ground Level ab'v tide.	Total Ascent	Total Descent	REMARKS.
	Interm'te Distances in Miles	Tot'l dis. from State line. and Feet.					
Kerr's Branch,	2.1440	165.5000	878.0	838.0	312.0	441.0	[and Charlotte Roads. Opposite Forks of Concord Near Mrs. Atwell's. Near Mrs. Partee's.
Sheppard's Cross-roads.	2.2440	168.2160	929.0	920.0		496.0	
Lincoln Road,	3.3760	172.0640	928.0	933.0	346.5	531.0	
Beaty's Ford Road,	7.4040	179.4680	926.0	929.0	406.7	593.0	
Central Railroad,	5.0600	185.0000	860.0	858.0	434.0	686.0	

EASTERN DIVISION.—SWANANOA ROUTE.

Table of Grades beginning at the mouth of Ward Creek, and ending at the Central Railroad.

From Station.	To Station.	FEET.			GRADE.		Elevation.	REMARKS.
		Distance.	Rise.	Fall.	Per 100 ft.	Per Mile.		
2,950	3,030	8,000		7	.17	9.0	677	
3,030	3,070	4,000					670	
3,070	3,140	7,000		2	.03	1.6	668	
3,140	3,170	3,000		3	.10	5.3	665	
3,170	3,221	5,100					665	
3,221	3,270	4,900		5	.10	5.3	660	
3,270	3,340	7,000					660	
3,340	3,385	4,500		15	.33	17.3	645	
3,385	3,430	4,500					645	
3,430	3,460	3,000		10	.33	17.3	635	
3,460	3,500	4,000					635	
3,500	3,570	7,000		11	.16	8.5	624	
3,570	3,610	4,000		1			623	
3,610	3,640	3,000		13	.43	22.7	610	

3,640	3,684	4,400	3	.07	3.7	607
3,684	3,768	8,400	2	.02	1.3	605
3,768	3,916	14,800	10	.21	11.0	595
3,916	3,955	3,900	6	.15	8.1	589
3,955	3,997	4,200	3	.07	3.8	586
3,997	4,032	3,500		.29	15.0	596
4,032	4,060	2,800	11	.40	21.0	585
4,060	4,118	5,800	4	.07	3.7	581
4,118	4,200	8,200	7	.09	4.5	574
4,200	4,206	600				574
4,206	4,235	2,900	11	.38	20.0	563
4,235	4,465	23,000				563
4,465	4,508	4,300	23	.54	28.5	586
4,508	4,548	4,000	38	.95	50.0	624
4,548	4,584	3,600	55	1.25	66.0	669
4,584	4,592	800				669
4,592	4,619	2,700	30	1.10	58.0	699
4,619	4,620	100				699
4,620	4,680	600				645
4,680	4,790	11,000	54	.90	47.5	740
4,790	4,820	3,000	10	.86	45.4	730
4,820	4,845	2,500		.33	17.6	741
4,845	4,940	9,500	11	.44	23.3	712
4,940	4,970	3,000	29	.30	16.0	695
			17	.57	30.0	

Catawba River crossing.

4,490 Mouth Island Creek.

Head of Elk Shoal Creek.
Buffaloe Shoal Creek.

(Continued on next page.)

WESTERN DIVISION.—Table of Grades Continued.

Fm. Sta'n	To Station.	FEET.		Fall.	GRADE.		Total Elev'n.	REMARKS.
		Distance.	Rise.		Per 100 ft	Per mile.		
4,970	4,990	2,000	10		.50	26.4	705	5,016 crossing Statesville road.
4,990	5,070	8,000					705	
5,070	5,190	12,000		16	.50	26.4	644	
5,190	5,210	2,000	4		.20	10.5	648	
5,210	5,330	12,000					648	
5,330	5,380	5,000		9	.18	9.5	639	
5,380	5,420	4,000	11		.28	14.5	650	
5,420	5,430	1,000					650	
5,430	5,523	9,300		20	.22	11.6	630	Near St. Michael's Church.
5,523	5,567	4,400		42	.95	50.0	588	
5,567	5,635	6,800	45		.66	35.0	633	Crosses Kerr's Branch.
5,635	5,696	6,100		74	1.21	64.0	559	
5,696	5,698	200					559	
5,698	5,730	3,200	27		.84	44.4	586	Mocksville road.
5,730	5,870	14,000	34		.24	12.7	620	
5,870	5,882	1,200		5	.42	22.0	615	
5,882	5,920	3,800	15		.40	21.0	630	
5,920	5,950	3,000		20	.66	35.2	610	Opposite line.
5,950	5,990	4,000		10	.25	17.6	600	
5,990	6,030	4,000	10		.25	17.6	610	
6,030	6,180	15,000		30	.20	10.5	580	

6,180	6,205	2,500	7	25	1.0	52.8	555
6,205	6,240	3,500			.20	10.5	562
6,240	6,290	5,000		7	.14	7.4	555
6,290	6,440	15,000	54		.38	20.0	609
6,440	6,475	3,500		29	.83	43.8	580
6,475	6,515	4,000	10		.25	13.2	590
6,515	6,540	2,500					590
6,540	6,560	2,000	10		.50	26.4	600
6,560	6,590	3,000		25	.83	43.8	575
6,590	6,633	4,300	5		.11	5.8	580
6,633	6,677	4,400		39	.88	46.5	541
6,677	6,704	2,700					541

Total ascent 494 feet in 18.9 miles; total descent 630 feet in 37.0 miles; level 15. 2 miles.
Total 71.1.

4 Average ascending grade for 18.9 miles, 26.1 feet; average descending grade for 37.0 miles, 17.0 feet.

WATAUGA ROUTE.—N. C. & WESTERN RAILROAD.

TABULAR ARRANGEMENT, showing the distances and Levels of all the prominent Points, from the State line to the intersection with the Swannanoa Gap line at the Horse Ford on Catawba River.

	Interm'te Distances in Miles	Total Distances. and Feet.	Levels a- bove Tide. Feet.	Interm'te ascend. Feet	Interm'te Descend. Feet.	REMARKS.
LEVEL AT STATE LINE.						
Thence to mouth Beech Mot. creek,	2.3140	2.3140	2130.84	317.50		Surface water W. a. river.
" point oppo. Mrs. Mast's,	9.5161	12.3021	2448.34	235.36		do do.
" turnpike bridge across Wat'ga river,	2.3388	15.1129	2683.70	101.19		
" head of P. Shull's mill pond on W. riv'r,	0.3071	15.4200	2884.89	32.47		Surface water W. a. river.
" mouth of Moody's mill creek,	2.1200	18.0000	2917.36	137.49		Grade Line.
" west. portal of tunnel on Boon Fork,	3.0000	21.0000	3034.85	295.00		ditto.
" summit Blue Ridge 1½ miles E. W. G.,	1.0640	22.0640	3349.85	428.93	578.93	
" eastern portal of tunnels,	0.2000	22.2640	3778.78		1560.00	
" station 395 on Gaskin river,	14.0000	36.2640	3199.85		230.00	Igr'd n'r Fac. 1260.00.
" terminus of 105 foot grade—sta. 510,	2.0940	38.3580	1409.85		130.00	Grade Line—Surface of
" Patterson,	2.0380	40.3960	1279.85			do. sum. Warrior Gap
" Warrior Gap,	2.3500	43.2180	1352.35	72.50	206.50	do. [1421.66.
" 1½ miles of Lenoir—val. of Jack's crk.,	2.2840	45.5020	1145.85			
" summit dividing ridge,	1.0220	46.5240	1225.85	80.00		

Thence to valley of Jack's creek,	1.0520	48.0480	1111.85	50.00	114.00	Surface of water.
" summit of dividing ridge,	0.1300	48.1780	1161.85			
" valley of Lower creek,	0.1800	48.3580	1101.85	243.00	60.00	Surface of water.
" sum't div. ridge L. & Gunpowder cr'ks,	1.4820	50.3120	1344.85			
" valley of Little Gunpowder creek,	1.1420	51.4540	1219.85	48.00	125.00	
" summit of ridge,	0.3000	52.2260	1267.85			
" Mrs. Connelly's mill p'd on big Gun.cr.,	0.3400	53.0380	1194.85	95.00	73.00	Surface of water.
" meeting house—top of ridge,	0.4200	53.4580	1289.85			
" Mrs. Brown's,	0.3700	54.3000	1264.85		25.00	
" little Gunpowder,	0.3400	55.1120	1153.85	98.00	111.00	Surface of water.
" summit of ridge at sta. 1415,	0.3500	55.4620	1251.85			
" Mrs. M. Martin's,	5.2800	61.2140	1129.50		122.35	
" Catawba river,	2.4440	64.1300	908.53		220.97	Surface of water
" intersection with Swananoa Gap line,	0.0680	64.1980	928.87			Sta. 3686.

WATAUGA ROUTE.

Table showing the Lengths and Portions of the Tunnels.

No.	LENGTHS.	POSITION.
	<i>Feet.</i>	
1	1,200	Four miles from State line.
2	200	Nine and a half miles from State line.
3	500	Near J. Ward's, ten and one-eighth miles from State line.
4	650	Through spur of Richland Mount, fourteen miles from State line.
5	7,920	Through Blue Ridge, one and a half miles east of Watauga Gap.
6	600	Through Ridge on eastern slope of Blue Ridge.
7	600	" "
8	600	" "
9	500	" "
10	1,400	" "
11	2,600	Through Blowing Rock Ridge.
12	2,600	Through Chesnut Mount Ridge, at Mulberry Spring Gap.
13	1,200	Through Town Site Ridge.
14	1,100	At Warrior Gap, in Warrior Mount.
15	800	Through dividing Ridge, bet'en Lower & Gunpowder Creek, can be avoided.
Total	22,470	Feet.

WATAUGA ROUTE.

TABULAR ARRANGEMENT showing the Levels and Distances of all prominent points from State Line to the Valley of John's River.

	Inter'ate distances, In Miles	Total dist. fr'm St'e line and Feet.	Level above Tide- Feet.	Total As- cent.	Total Descent.	REMARKS.
LEVEL AT STATE LINE.						
From State Line to mouth Beech Mt. cr'k.,	2.3140	2.3140	2130.84			Surface water.
Thence to point opposite Mrs. Mast's,	9.5161	12.3021	2448.24	317.40		do. do.
" turnpike Bridge,	2.3388	15.1129	2683.70	552.86		
" head of Shull's mill pond,	0.3071	15.4200	2884.89	754.05		
" Watauga river—Boon Fork line,	0.3300	16.2220	2917.36	786.52		Surface water.
" western portal of Tunnel,	1.2120	17.4340	2942.35	811.51		do. do.
" Sum. of Blue Ridge at Watauga Gap,	2.5140	20.4200	3102.85	972.01		Grade Line.
" foot of Mountain, east side,	4.0000	24.4200	3469.85	1339.01	1757.00	
" Carroll Moore's,	3.0000	27.4200	1512.85		2122.00	
<i>Moody's Mill Creek Line.</i>						
Head of Shull's mill pond,	3.0000	15.4200	2917.36			
Thence to western portal of Tunnel,	3.0000	18.4200	3109.85	192.49		Grade Line.
" summit of Blue Ridge,	1.2720	20.1640	3774.24	756.88		
" eastern portal of Tunnel,	0.2700	20.4340	3030.23		744.01	Grade Line.

WATAUGA ROUTE.

TABLE OF GRADES on the Watauga Route of N. C. & Western R. R.—Total distance 64 3-8 miles.

No. of Station.	Length of Grade. miles & feet	Rise per Mile. feet.	Fall per mile. Feet.	Remarks.
From				
1109 to 929	2.2190	94.00		Commencing at the State line and running up valley of the Watauga River.
929 820	1.3927	26.00		
820 802	0.1800	0.00		
802 770	0.3260	64.00		
770 737	0.3300	30.00		
737 722	0.2147		52.00	
722 655	1.1388	35.00		
655 637½	0.1700		19.00	
637½ 601	0.3825	38.00		
601 563	0.3800	11.00		
563 514	0.4900		16.00	Sta. 435 con't of M. D. Sta. 295 at Tu'ke Br'ge.
514 480	0.3400	34.00		
480 450	0.3000		11.00	
450 435	0.1500	44.00		
435 295	2.3399	74.00		
295 240	1.0070	62.18		
240 218	0.2209	28.70		
218 200	0.1800	52.80		
200 151	0.5185	71.30		
151 107	3.0000	98.33		
107 118	1.2640		10000	Th'gh Blue R. Tunnel.
118 395	14.0000		11140	Down Ea'rn slope B. R
395 510	2.0940		10500	
510 556	0.4600		96.00	Sta. 566 Va'ly Y. R'r.
556 584½	0.2850		60.00	
584½ 619	0.3450		22.00	
619 660	0.4100		34.00	Sta. 626 op. Patterson.
660 700	0.4000	34.00		
700 756½	1.0770	64.00		Sta. 756½ Warrior Gap
756½ 890	2.2790		83.00	Can be reduced.
890 939	0.4900	39.00		
939 982½	0.4350		63.00	
982½ 1028½	0.4600		Level	Sta. 1015 M'ng House m'es e'st Le'r&a'bt 2

Table of Grades Continued.

No. of Station.		Lengths of Grade miles & feet	Rise per Mile. feet.	Fall per Mile. Feet.	Remarks.
1028 $\frac{1}{2}$	1167 $\frac{1}{2}$	2.3340	64.00		
1167 $\frac{1}{2}$	1212 $\frac{1}{2}$	0.4500		64.00	Sta. 1135 sum't of R'ge be'en L. C. & G. C.
1212 $\frac{1}{2}$	1235	0.2250	34.00		
1235	1264 $\frac{1}{2}$	0.2950		54.00	Can be reduced.
1264 $\frac{1}{2}$	1314	0.4950	64.00		
1314	1380	1.1320		70.00	
1380	1415 $\frac{1}{2}$	0.3450	63.00		
1415 $\frac{1}{2}$	1428 $\frac{1}{2}$	0.1300		Level	
1428 $\frac{1}{2}$	1476	0.4750		45.00	
1476	1533 $\frac{1}{2}$	0.0470	13.00		
1533 $\frac{1}{2}$	1562	0.2850		51.00	
1562	1588	0.2600		Level	
1588	1652 $\frac{1}{2}$	1.1170		64.00	
1652 $\frac{1}{2}$	1685	0.3250	10.00		
1685	1700	0.1500		10.00	
1700	1735	0.3500	10.00		
1735	1853	2.1240		83	Can be reduced.
1853	1863 $\frac{8}{10}$	0.1050		Level	Across Catawba Riv'r.
Total,		64.1980			

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